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(54) Title: WORKFLOW SERVER FOR MEDICAL RECORDS IMAGING AND TRACKING SYSTEM
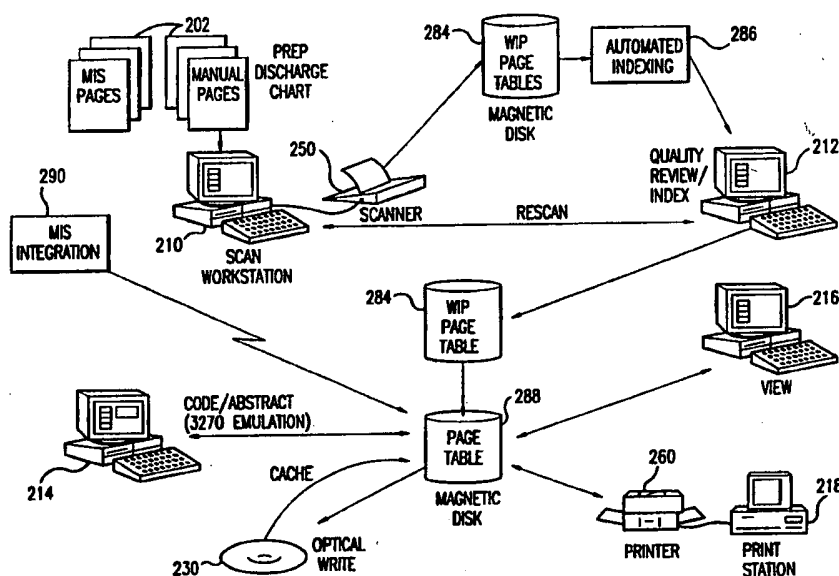
(57) Abstract

A computer system with a workflow server that provides for automatic and prioritized assignment of work involving processing of medical information records (202) to particular resources in a hospital. When medical records are no longer needed, it may be written by the file server on to optical disk (230). A page table (28) may also receive data on medical records (202) via MIS integration block (290). Documents are accessed via the file server at coding/abstracting workstation (214) or via work-station (216). A plurality of such workstations may be attached to the file server to perform chart coding/abstracting and chart deficiency completion. Documents may also be accessed at print station (218) and printed on printer (260).

WORKFLOW SERVER FOR MEDICAL RECORDS
IMAGING AND TRACKING SYSTEM

BACKGROUND OF THE INVENTION

5   Maintaining patient medical records, whether for
an individual doctor or for the entire medical staff
of a major hospital, presents many complications,
which may be grouped broadly into three categories.

First, pertinent information for any one patient
10   may come from an array of sources, including physical
and medical history information provided by the
patient, radiology reports, clinical and anatomical
pathology reports, EKG readouts, physician orders,
nursing notes, care plans, and insurance providers.

15   Second, upon discharge, a patient's medical
record data is typically reviewed extensively. This
includes reviews of the physician's attestation, of
documentation of the treatment process, of all charts
to ensure that they are complete, and of procedures
20   and notes to be abstracted. If data is incomplete,
payment organizations such as insurers may deny claims
made by a health care provider.

Third, any number of parties require access to
patient information, including hospitals, clinics,
25   attorneys, regulatory agencies, courts, whoever pays
the bills, and naturally the patients themselves.
Keeping track of requests for access from these varied
sources is quite burdensome.

Most medical record systems in use today are
30   either paper-based or make use of computer systems
only to a limited extent. Optical imaging systems
have been used to scan printed documents into a
computer system for storage, retrieval, viewing, and
printing, but these systems do not provide the
35   management functions needed to deal effectively with

the myriad tasks described above. Health care
providers are finding that existing systems and
methods of managing medical records are not meeting
demands placed upon them.

5   In particular, two administrative bottlenecks in
the use of such systems are the coding/abstracting of
medical records and the assigning of deficient medical
records (e.g., missing data or signatures) to proper
personnel for completion.

10   Existing systems typically store documents in a
database on a file server to which a plurality of
client workstations are attached. Standard database
functions may be used in such systems to establish
workflow assignments. But such a database-centered

15   approach to workflow has disadvantages. Because
databases are not specifically structured to
accommodate the types of transactions required for
workflow processing, using standard database functions
to carry out such transactions would be inefficient,

20   resulting in unacceptable system performance. This is
especially so if sophisticated workflow processing
functions are implemented, such as a prioritized
assignment of work to particular personnel based on
predetermined criteria to specify which employees will

25   receive particular types of work.

          A system that allows sophisticated workflow
processing while maintaining acceptable system
performance would be useful. In addition, in view of
the present use of optical imaging technology for data

30   input to the records system, it would be desirable to
use such technology in a more automatic system.

                   SUMMARY OF THE INVENTION
          The present invention provides a system that

35   utilizes an application approach to workflow

processing. The system includes a number of
application programs. One of the application programs
is a workflow server that runs as a background
procedure on the file server to control the routing of

5   work between application program tasks and individual
resources accessing the system via client
workstations. The workflow server services requests
from other application programs within the system.
This eliminates the inefficiencies that result from a

10   database-centered approach to workflow processing, and
allows for sophisticated levels of workflow
processing.

In particular, as the system stores data
regarding additional medical information records

15   (typically documents) in a relational database, it
identifies which such additional records constitute a
new encounter (i.e., an inpatient or outpatient
admission) for a particular patient. An encounter
comprises one or more visits by a patient. The system

20   next defines one or more first subsets of records,
called visit cases, for each encounter. For each
visit case, the system may define second subsets of
records for one or more of a number of application
programs.

25   The different application programs correspond to
different states within the system. Such states may
include coding/abstracting of documents and assigning
deficiencies in documents for completion. Preferably,
the coding/abstracting application program processes

3C   each visit case, while the assign deficiency
application program defines deficiency cases as
subsets of each visit case for processing by the
assign deficiency application. In response to
requests from other application programs, the workflow

35   server then routes each defined case to a particular

workqueue within the proper application program state.
A workqueue is an ordered collection of record subsets
(cases) within a state, the contents of which is
determined by selection criteria stored in the system.

5   If desired by a user, a workqueue administration
application program assigns each case to a particular
resource (e.g., a hospital employee) within each
workqueue.

The selection criteria for the type and number of
10 workqueues within each state and the selection
criteria for the assignment of resources within each
workqueue are identified with whatever sophistication
or prioritization that a hospital may desire.
Specifically, the selection criteria are specified as
15 parameters in a configuration file that is processed
when the system is started (i.e., at "run time"). The
parameters in the configuration file implement a "code
as data" approach: the parameters constitute data that
indicate which of a number of segments of program code
20 the system should execute when processing that case.
Other parameters may be set in the configuration file,
for example, to allow for parallel routing of cases,
and for synchronous or asynchronous routing of cases.

The selection criteria parameters in the
25 configuration file may be varied by system
administrators before starting the system, (for
example, at the beginning of each day) in order to
vary the configuration of the workqueues. Thus, the
workqueues are said to be configurable at run time.

30 The workflow server also performs an initial load
of the database into memory in order to route cases
defined by the system to the appropriate workqueues
within the appropriate states and sort the cases
within the workqueues. A data-consistent image of the
35 database is thus maintained in memory. Any

modifications to the data are written to the database
as stored within the system.

The system of the present invention is preferably
adapted to run on a client/server system such as
5   Hewlett-Packard's Advanced Image Management System,
with client workstations using an operating
environment such as Microsoft Windows®.

A medical records imaging and tracking system
incorporating a workflow server according to the
10   present invention can reduce the storage space needed
by hospitals for medical records, reduce backlogs in
concluding such tasks as coding/abstracting and
completing chart deficiencies by providing multiple
user access to the same documents (which may be
15   required for both tasks), increase a hospital's cash
flow by reducing the DNFB (discharged, not final
billed) period for patients, and improving medical
record keeping operations by improving the accuracy of
coding/abstracting and standardizing the chart
20   completion process.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects, features and advantages
of the present invention will be more readily apparent
25   from the following detailed description of the
invention in which:

FIG. 1 is a block diagram showing a hardware
configuration according to one embodiment of the
present invention;

30   FIG. 2 is a block diagram showing a hardware
configuration according to another embodiment of the
present invention;

FIG. 3 is a schematic diagram depicting aspects
of the implementation of a workflow server according

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to the present invention in a system such as that of
FIGS. 1 or 2;

FIGS. 4-6 are flowcharts presenting an overview
of the operation of a medical records imaging system
5   utilizing a workflow server according to the present
invention; and

FIGS. 7-9 are flowcharts depicting operation of
one embodiment of a system employing a workflow server
according to the present invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows one possible hardware configuration
for a system according to the present invention. PC
workstations 10 are attached to data server 20, which
15   is attached to optical disk drive 30. Data server 20
passes information stored on optical disk drive 30 to
the proper PC workstation 10. An optical scanner 50
(which may include a bar code reading capability) is
attached to one PC workstation 10, and a printer 60 is
20   attached to the other PC workstation 10. For this
configuration, one PC workstation 10 might be at a
nurse's desk, while the other PC workstation 10 might
be in a doctor's office.

FIG. 2 shows another possible hardware
25   configuration. PC workstations 110 are attached to
mainframe computer 120 via local area network
(LAN) 115. Minicomputer 130 is also attached to
mainframe computer 120 via LAN 115, and jukebox disk
file cabinet 140 is attached to minicomputer 130.
30   Each of PC workstations 110 may have direct access to
data on mainframe computer 120, or indirect access to
data on jukebox disk file cabinet 140 via
minicomputer 130. Optical scanner 150 (which
preferably includes a bar code reading capability),
35   printer 160, and optical character reader (OCR) 170

may each be attached to one of PC workstations 110.
This configuration might be used for an entire small
hospital or a single department in a large hospital.
Those of skill in the art will recognize that numerous
5   other hardware configurations for the system of the
present invention are possible.

FIG. 3 is a schematic diagram showing aspects of
a system incorporating a workflow server according to
the present invention. Scan workstation 210 processes
10 medical record documents 202 received via scanner 250
(which may include a bar code reading capability).
Identifying data regarding each document received is
stored by scan workstation 210 in a work-in-progress
(WIP) page table 284 maintained on a magnetic disk by
15 a file server (not shown). Such identifying data
(including document identification (ID) number,
document type, and page number) may be included in a
bar code placed on each document before scanning.
Data in the WIP page table 284 is processed by an
20 automated indexing program 286 running on the file
server, which allows for searching and sorting
operations on documents received.

Documents that have been scanned may be reviewed
at quality review/index workstation 212. Here, an
25 operator may examine the image quality of scanned
documents and determine if rescanning of any documents
is necessary. In addition, if automated indexing at
block 286 was unsuccessful for any document (e.g., a
document contained no bar code), the operator may
30 perform the indexing for that document. Information
is updated as necessary in WIP page table 284, and
then is transferred by the file server to page
table 288, a relational database that contains data
regarding all medical records, which is also
35 maintained on a magnetic disk. When medical record

data is no longer needed for speedy access, it may be
written by the file server onto optical disk 230. A
cache may be employed when the file server wishes to
retrieve information stored on optical disk 230.

5   Page table 288 may also receive data on medical
record documents via MIS integration as indicated at
block 290. This process, performed via the file
server, allows the entry of documents and other data
from other computer systems. One example of MIS
10   integration would be to provide a direct interface to
a hospital's computerized admission registration
system.

Documents may be accessed via the file server at
coding/abstracting workstation 214, or view work-
15   station 216. A plurality of such workstations may be
attached to the file server to perform such functions
as chart coding/abstracting and chart deficiency
completion. Documents may also be accessed at print
station 218 and printed on printer 260.

20   FIGS. 4-6 present an overview of the operation of
a system utilizing a workflow server according to the
present invention in an embodiment suitable for a
hospital. As seen in FIG. 4, before a user signs on
to the system at block 310, various records 302
25   (including medical records, trauma center records,
miscellaneous medical record documents, and release of
information documents) may be received and prepared
for entry at block 304. Various MIS documents 306,
electronically stored on one or more other computer
30   systems, may be accessed via MIS interface 308.

At block 310, a user may sign on to the system,
preferably by entering a user identification code and
a password via a keyboard and CRT display of a PC
workstation. If the system determines, based on
35   previously entered information stored in the system,

that a valid user identification code has been
entered, and that the proper password for that user
identification code has been entered, access to
further features of the system is allowed.

5   If access is allowed, the system presents via the
CRT display a menu of choices for the following system
features: scan, administrative functions, and system
maintenance/utilities. This and other menu choices
used throughout the system may be presented

10 horizontally across a portion of the CRT display
(e.g., toward the top), in a "pull-down" or "pop-up"
menu, or by other means known to those of skill in the
art.

        If the user selects the menu choice for scan, the

15 system proceed to block 312, where the user may have
documents entered into and stored on the system via an
optical scanner. The system them proceeds to
block 322, where document recognition is performed.
Document recognition preferably is carried out by

20 reading a bar code. Other methods known to those of
skill in the art, such as optical character
recognition (OCR), may also be used. The system then
presents the user with a menu of choices for the
following features: release of information and quality

25 review. If the user selects the menu choice for
release of information, the system proceeds to block
324, where the system tracks the information to be
released, preferably by storing identifying data
regarding the scanned document in a file for such

30 data. The system then proceeds to block 326 where the
information to be released is printed, and then the
system proceeds to block 328, where the user is signed
off the system. If the user selects the menu choice
of quality review, the system proceeds to block 330,

35 where tests are performed to determine whether the

optical character recognition was performed
successfully and whether the scan quality of the
scanned document is acceptable. The system then
proceeds to block 332. If the scanned document does
5 not pass the quality review test, the system returns
to block 312 and the user may attempt to scan the
document again; if the scanned document passes quality
review, the system proceeds, as will be discussed
below.

10   If, following sign on at block 310, the user
selects the menu choice for administrative functions,
the system proceeds to block 314, where the user is
presented with a number of choices. These may include
valid user passwords; assigning and changing security
15 authorization levels for each user identification
number; adding or deleting patients from workqueues;
updating patient data; adding or deleting record
status information; and other functions dealing with
administration of the system. The system then
20 proceeds to block 318, where the user is signed off
the system. Another menu choice that may be presented
to the user is for system maintenance/utilities, as
indicated at block 316, where the user is again
presented with a number of choices. These may include
25 moving records from a magnetic storage device to an
optical storage device and other functions dealing
with maintenance of the system. The system then
proceeds to block 320, where the user is signed off
the system. Typically, however, a general user would
30 not be given access to such maintenance functions, and
block 316 would be accessible only to certain
authorized users.

     If, at block 332, the system determined that
quality review was passed, the user is presented with
35 a menu of choices for the following features: view,

chart tracking, code, abstract, severity of illness
abstract, reporting, and assign deficiency.

As shown in FIG. 5, if the user selects the menu
choice for view, and if the system determines that the
5   user is authorized to view information records stored
on the system, the system proceeds to block 334. At
block 334, the user may search for and display any
information record. The user may search the system
using, for example, a patient's name, an identifying
10   number for a patient, or dates of admission or
discharge; other search criteria may also be employed.
Subsets of data may also be retrieved, e.g., selected
documents for a patient for a particular physician.
If a displayed information record includes certain
15   document image data, such as a graphic display of an
EKG strip, the user may magnify and rotate the
document image data so that a different view is
displayed.

After the user has finished viewing records, the
20   user may choose a menu choice for signing off the
system, in which case the system proceeds to block
336, or the user may choose a menu choice for printing
a record, in which case the system proceeds to block
338, where the record is printed, and then proceeds to
25   block 340, where the user is signed off.

If the user selects the menu choice for chart
tracking, and if the system determines that the user
is authorized, the system proceeds to block 342.
There the user may search for any record stored on the
30   system and retrieve information on the number of
requests for medical chart information, to whom such
information was submitted, and (if appropriate) when
such information was returned. The system then
proceeds to block 344, where the chart tracking

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information is printed, and then proceeds to sign off
the user at block 346.

If the user selects the menu choice for code, and
if the system determines that the user is authorized,
5   the system proceeds to block 348. There the user may
search for any record stored on the system and view a
predefined subset of information regarding that
record. As shown at block 350, the user may also
enter appropriate diagnosis and procedure codes. For
10 example, ICD-9-CM diagnosis and procedure codes and
CPT-4 codes may be entered, via emulation of a
terminal (e.g., IBM 3270) connected to a mainframe or
minicomputer running encoding/grouping software.
Following coding, the system proceeds to sign off the
15 user at block 352.

If the user selects the menu choice for abstract,
and if the system determines that the user is
authorized, the system proceeds to block 354. There
the user may search for any record stored on the
20 system and view another predefined subset of
information regarding that record. As shown at
block 356, the user may also enter abstract data. For
example, a hospital's Case Mix System (CMS) abstract
data may be entered via terminal emulation (e.g.,
25 IBM 3270) of a CMS online CSP data entry system.
Following entry of abstract data, the system proceeds
to block 358, where the user is signed off.

If the user selects the menu choice for severity
of illness abstract, and if the system determines that
30 the user is authorized, the system proceeds to
block 360. There the user may search for any record
stored on the system and view yet another predefined
subset of information regarding that record. Users
may compare the displayed document image to a hard

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copy medical record to complete forms, such as
Medisgroup Abstract forms.

If the user selects the menu choice for
reporting, and if the system determines that the user
5   is authorized, the system proceeds to block 364.
There the user may request one or more reports from a
predefined set of reports. Such reports may include
application and control reports (e.g., data on chart
deficiencies, chart tracking, correspondence),
10 productivity reports (e.g., number of medical records
updated by each medical records clerk), and management
reports (e.g., weekly data to monitor departmental
productivity against previously defined goals). After
the user requests the reports, the system proceeds to
15 block 366, where the reports are printed, and then to
block 368, where the user signs off.

As shown in FIG. 6, if the user selects the menu
choice for assign deficiency, and if the system
determines that the user is authorized, the system
20 proceeds to block 370. There the system allows the
user to view a predefined subset of records of an
encounter (an inpatient or outpatient admission) and
to assign medical record deficiencies to one or more
physicians by entering one or more physician
25 identification numbers. The user may also assign a
status code of "hold" to a record (to mark its place
in a workqueue while processing is delayed), or a code
of "pend" (to place it back in a workqueue on a
pending date).
30 After a user completes the assign deficiency
function, the system presents the user with a menu of
choices for the following features: complete
deficiency, update deficiency, inquire deficiency,
completion status tracking, generate reports, generate
35 physician letters, and update physician status.

        If the user selects the menu choice for complete
deficiency, and if the system determines that the user
is authorized, the system proceeds to block 372.
There the system allows the user to view only the
5   medical record deficiencies assigned to that user
during the assign deficiency function at block 370.
The system allows the user to complete deficiencies in
medical record documents (e.g., an admission record),
sign either Diagnosis Related Group (DRG) attestations
10 or entire medical records electronically via keyboard,
mouse, or other entry, or view a subset of an
encounter lacking dictation so that a physician may
dictate medical record documents (e.g., discharge
summaries, consultations, or operative reports). When
15 all deficiencies are removed, the system changes the
status of a chart to "complete". After the user has
finished the complete deficiency function, the system
proceeds to block 374 where the user signs off.
        If the user selects the menu choice for update
20 deficiency, and if the system determines that the user
is authorized, the system proceeds to block 376.
There the system allows the user to update information
that was entered in the assign deficiency function at
block 370. After the user has finished the update
25 deficiency function, the system proceeds to block 378,
where the system determines whether all deficiencies
are complete for the records updated by the user. If
not, the system proceeds to block 372 to allow an
authorized user to complete the deficiencies; if so,
30 the system proceeds to block 380, where the user signs
off.
        If the user selects the menu choice for inquire
deficiency, and if the system determines that the user
is authorized, the system proceeds to block 382.
35 There the system allows the user to view the

deficiency status of each incomplete medical record,
the provider status for a physician (described below),
and the total number of deficient medical records
(incomplete and delinquent) for a physician. After
5   the user has completed the inquire deficiency
function, the user signs off at block 384.

    If the user selects the menu choice for
completion status tracking, and if the system
determines that the user is authorized, the system
10 proceeds to block 386. There the system, preferably
through batch processing, allows the user to track a
physician's provider status and record deficiency
status. The provider status is with regard to medical
record completion, and preferably indicates by codes
15 one of four conditions: (1) current -- no incomplete
records; (2) incomplete; (3) delinquent; and
(4) suspended. The system maintains for each
encounter a count of the number of days a physician
allows a deficiency to remain. When the number of
20 days exceeds a predefined parameter (e.g., 30 days),
the system updates the provider status and the record
deficiency status to "delinquent". The codes for
provider status and record deficiency status are made
available to the user in the system functions for
25 update deficiency (block 376), inquire deficiency
(block 382), reporting (block 390), and generate
physician letters (block 394), so that authorized
users may act on such statuses when using these system
functions. When the user has finished the completion
30 status tracking function, he signs off at block 388.

    If the user selects the menu choice for
reporting, and if the system determines that the user
is authorized, the system proceeds to block 390.
There, as at block 364 the system allows the user to
35 request a predefined set of reports to be printed

either immediately or through batch processing at a
later time (e.g., over night). After the user has
completed the reporting function, the system proceeds
to block 392, where the user signs off.

5   If the user selects the menu choice for generate
physician letters, and if the system determines that
the user is authorized, the system proceeds to
block 394. There the user may request the printing of
notification letters regarding deficiencies addressed

10 to individual physicians. One or more versions of
such notification letters (e.g., first and second
notification) are stored on the system as document
images in the chart deficiency database. Other
versions of such letters may also be scanned into the

15 system. After the user completes the generate
physician letters function, the user signs off at
block 396.

        If the user selects the menu choice for update
physician status, and if the system determines that

20 the user is authorized, the system proceeds to
block 398. There the user may change status codes for
individual physicians. Such status codes may include
provider status (defined above); activity status
(e.g., (1) active admitting staff, (2) active non-

25 admitting staff, (3) active resident staff, and
(4) inactive staff); and availability status (e.g.,
(1) available, (2) vacation, (3) illness, (4) leave of
absence). When the user has completed the update
physician status function, the system proceeds to

30 block 400, where the user signs off.

        FIGS. 7-9 are flowcharts that depict the
operation of a workflow server according to the
present invention. The workflow server is preferably
implemented on the file server as a single application

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program that runs in the background while other client
application programs may be run.

One such client application is the scan
application program, which processes the entry of
5 medical record document data into page table 288. As
shown in FIG. 7, the scan application starts at
block 500 and proceeds to block 502, where the scan
function is performed. By monitoring the document IDs
as they are scanned at block 502, the scan application
10 determines when all of the documents for a single
batch of documents have been entered, preferably by
the use of one or more identifying cover documents.
After a batch of documents is scanned, the application
proceeds to block 504 to determine if one or more
15 oversized documents were scanned. If so, the
application proceeds to a cut function at block 506,
and then to block 508; if not, the application
proceeds directly to block 508, where the quality
review (QR) function is performed.
20 The scan application program proceeds to
block 510, where an operator determines if a document
will be accepted. If not, the application proceeds to
block 512 so that the operator may decide whether to
rescan the document. If a rescan is desired, the
25 application returns to the scan function at block 502;
if not the application proceeds to block 514. There
the operator may decide whether to delete the
document. If deletion is desired, the application
proceeds to block 516, where the document is deleted,
30 and then to the start of the application at block 500;
if not, the application returns to block 512.

If, at block 510, the operator determines that a
document will be accepted, the scan application
program proceeds to block 518, where a WIP-to-page
35 application program running on the file server

transfers data from WIP page table 284 to page
table 288. The file server may also transfer data
received via interfaces from ancillary systems (e.g.,
from MIS integration 290) to page table 288.

5   Optionally, the system may also send information to
ancillary systems, as indicated at block 520.

As part of the processing at block 518, the WIP-
to-page application analyzes the documents in the page
table to create for each encounter subsets of records

10   called visit cases. Each visit case contains
documents related to an encounter that are to be acted
upon by various application programs within the
system. The workflow server maintains data regarding
states that correspond to each of those application

15   programs. Examples of this would be two states that
correspond to the two application programs that
implement the coding/abstracting function and the
assign deficiency function. The workflow server
routes each case to a workqueue within a state. If

20   more than one resource is listed within a workqueue, a
workqueue administration application then can assign
each case to a resource (e.g., a hospital employee)
listed. If only one resource is listed, the case is
assigned to that resource. Alternatively, the

25   workflow server may include workqueue administration
functionality, such that a separate application for
resource assignment would be unnecessary.

As shown in FIG. 8, the system proceeds to
blocks 530 and 540, where processing of the

30   code/abstract and the assign deficiency application
programs proceed in parallel. When a visit case
contains documents to be processed by the
code/abstract application program, that application
program sends a request to the workflow server, which

35   routes the visit case and sets it in one of the

code/abstract workqueues, as indicated at block 532.
The case is then routed to an individual resource
(employee) for coding/abstracting, as indicated at
block 534.

5   When the workflow server receives a request from
the system, typically via a system administrator, to
load cases from the database, the workflow server
performs an initial load of the database into run-time
memory. Run-time memory is typically read/write

10 random access memory (RAM). The workflow server
identifies which data comprises the cases that have
been defined by the system and, in response to the
first and subsequent requests from the application
programs, routes that data to the appropriate

15 workqueues within the appropriate states and sorts the
cases within the workqueues. Whenever modifications
to the data are made, the modifications are made in
memory and the application program that makes the
modifications sends a request for the workflow server

20 to write the modifications from memory to the database
as stored within the system. Thus, while a data-
consistent image of the database is kept in memory,
the system take steps to help maintain the integrity
of data within the system.

25   At block 536, an operator determines whether a
case has been completed. If the operator decides to
"hold" or "pend" the case, it is taken out of the
workqueue and returned for further handling by the
workflow server at block 532, where the case can be

30 placed back in a workqueue at a later time. If the
operator determines that the case has been completed,
this portion of the system stops at block 538. In
another embodiment, the system would define
coding/abstracting cases at block 532 as subsets of

35 each visit case for processing by the

coding/abstracting application, and the subsequent
actions at blocks 532, 534, and 536 would be performed
on the coding/abstracting cases.

The system proceeds from block 540 when a visit
5   case contains documents to be processed by the assign
deficiency application program. At block 542 that
application program creates a deficiency case and
sends a request to the workflow server to route the
deficiency case and set it in one of the assign
10 deficiency workqueues. The deficiency case is then
routed to an individual resource (employee) to assign
the document deficiency as indicated at block 534. At
block 546, an operator determines whether a case has
been completed. Again, if the operator decides to
15 "hold" or "pend" the case, it is taken out of the
workqueue and returned for further handling by the
workflow server at block 542, where the case can be
placed back in a workqueue at a later time.

At block 544, a document within a deficiency case
20 may be assigned, for example, to a particular
physician responsible for completing the document for
a particular patient encounter. The assign deficiency
application program will create another subset case of
documents out of the deficiency case and send a
25 request for the workflow server to route the new case
to be set in a physician workqueue for deficiency
completion, as represented at block 548. When a
physician logs onto the file server via a
workstation 216, the workflow server will allow that
30 physician to deal only with cases containing documents
which that physician must complete. For example, a
document missing a DRG attestation may be signed via
an electronic signature stored on the file server. At
block 552, the physician determines whether a case has
35 been completed. A physician may also decide to "hold"

or "pend" the case; if so, it is taken out of the
workqueue and returned for further handling by the
workflow server at block 548, where the case can be
placed back in a physician workqueue at a later time.

5   The selection criteria used by the workflow
server to determine the number of workqueues within
each state, and which cases are routed to which
workqueues, are contained as parameters in a
configuration file. The configuration file is
10   processed by the workflow server when the system is
started, thus allowing for run-time configuration of
workqueue selection criteria.

The parameters in the configuration file
implement a "code as data" approach. The parameters
15   indicate, for example, to which workqueue a particular
case is assigned by indicating which program code the
system should execute when processing that case. In
another embodiment, the selection criteria for
assigning resources within workqueues, used either by
20   the workflow server or a workqueue administration
application, may also be specified as parameters in
the configuration file. Other embodiments may set
further parameters in the configuration file, such as
to allow for parallel routing of cases, or synchronous
25   or asynchronous routing of cases.

Preferably, the workflow server maintains a table
on a magnetic disk to store data regarding: the states
available to the system for workflow processing; the
workqueues available within each state; the resources
30   available within each workqueue; the criteria for
forming cases for each state; the criteria for routing
cases to each workqueue; and the criteria for
assigning cases to each resource.

The workflow server thus allows for automating
35   and prioritizing the workflow of assigning cases to

resources at run time with whatever sophistication a hospital requires. Based on an individual hospital's needs, several workqueues may be established for each state, and rules regarding the resources may be
5 established for each workqueue. For example, if a hospital employs four persons to handle coding/abstracting, it may decide that two particular employees should handle that task for in-patients and the other two should work on out-patients. The
10 workflow server may be configured to provide two workqueues in the coding/abstracting state, one for in-patients and one for out-patients.

Within each of those two-employee categories, the hospital may determine that it wants one employee to
15 work on coding/abstracting of Medicaid documents, and the other to work on Medicare documents. A workqueue administration application (or the workflow server provided with the same functionality) can assign a particular code/abstract case within a particular
20 workqueue to a particular resource. When, for example, the hospital employee charged with coding/abstracting in-patient Medicaid documents logs onto the file server via a workstation 214, the workflow server will allow that employee to deal only
25 with cases containing in-patient Medicaid documents.

Alternatively, four separate workqueues could be set up for coding/abstracting of in-patient Medicaid documents, in-patient Medicare documents, out-patient Medicaid documents, and out-patient Medicare
30 documents, with a single resource (employee) assigned to each workqueue.

As shown in FIG. 9, if a visit case is indicated to be completed at blocks 546 or 552, processing proceeds to block 560, where page table 288 is updated
35 to indicate what deficiencies have been completed. As

indicated at block 562, the discharge date for a case
is checked. If, at block 564, a valid discharge date
is not indicated, processing returns to block 562. If
a valid discharge date is indicated, the system
5   determines if certain user defined conditions (OPT1)
have been met, at block 566; if they have not been
met, the system determines whether certain other
conditions (OPT2) have been met, at block 568. If the
OPT1 or OPT2 conditions have been met, processing
10 continues to blocks 570 and 572, respectively, where
the case data is written to a write-once, read-many
(WORM) optical disk. The system then proceeds to
block 574, where the database index of page table 288
is updated, and then to block 576. There, the system
15 determines whether the case is incomplete. If so, the
system returns to the start of the scan function at
block 500; if not, this portion of the system stops at
block 578.

While the system, as described, preferably
20 includes two application program states --
coding/abstracting and assign deficiencies -- other
embodiments may include further application program
states. The may process visit cases or other subsets
of visit cases which would be defined by the other
25 application program states.

A workflow server according to the present
invention also preferably provides the capability for
an operator to access the various workqueues via a
workstation in order to override the case-to-resource
30 assignments previously made by the workqueue
administration application. For example, if a
hospital employee is absent on a particular day, an
administrator can transfer cases from that employee's
workqueue to another employee's workqueue.
35

What is claimed is:

1. A computer system for storing and tracking medical information records comprising:

5   means for storing data in a run-time memory;

means for storing data regarding the medical information records in a relational database;

means for loading the data regarding the medical information records into the run-time

10   memory;

means for running one or more application programs, each of which performs one or more operations on the data regarding the medical information records;

15   means for identifying when data constituting a predefined set of data has been added to the database;

means for forming one or more first subsets of said predefined set of data, each subset being

20   formed according to predefined first subset criteria;

means for forming one or more second subsets of each of said one or more subsets, each second subset being formed according to predefined

25   second subset criteria for a specific application program;

workqueue routing means, responsive to a request from one of the application programs, for routing each first subset, according to

30   predefined workqueue routing criteria, to a workqueue for one of the application programs, and for routing each second subset, according to predefined workqueue routing criteria, to a workqueue for the application program whose

35

predefined second subset criteria were used to
form the second subset; and

resource assigning means for assigning each
first subset and second subset, according to
predefined resource assigning criteria, to a
resource for one workqueue,

whereby a user identified to the system as a
particular resource running a particular
application program is allowed access only to
those first subsets or second subsets assigned to
that particular resource for that resource's
associated workqueue for the particular
application program that is running.

2. A computer system as claimed in claim 1
further comprising means for storing configuration
data regarding the application programs, the
workqueues for each application program, the resources
for each workqueue, the predefined first and second
subset criteria, the predefined workqueue routing
criteria, and the predefined resource assigning
criteria.

3. A computer system as claimed in claim 2
wherein said means for storing configuration data
comprises a run-time configuration file.

4. A computer system for storing and tracking
medical information records comprising:

means for storing data regarding the medical
information records in a relational database;

means for running one or more application programs, each of which performs one or more operations on data in said database;

means for identifying when data constituting a predefined set of data has been added to the database;

means for forming one or more subsets of said predefined set of data, each subset being formed according to predefined subset criteria;

workqueue routing means for routing each subset, according to predefined workqueue routing criteria, to a workqueue for one of the application programs; and

resource assigning means for assigning each subset, according to predefined resource assigning criteria, to a resource for one workqueue,

whereby a user identified to the system as a particular resource running a particular application program is allowed access only to those subsets assigned to that particular resource for that resource's associated workqueue for the particular application program that is running.

5. A computer system as claimed in claim 4 further comprising means for storing configuration data regarding the application programs, the workqueues for each application program, the resources for each workqueue, the predefined subset criteria, the predefined workqueue routing criteria, and the predefined resource assigning criteria.

6. A computer system as claimed in claim 5
wherein said means for storing configuration data
comprises a run-time configuration file.

5

7. A method for storing and tracking medical
information records on a computer system comprising
the steps of:
        storing data regarding the medical
10   information records in a relational database;
        identifying when data constituting a
predefined set of data has been added to the
database;
        loading the data regarding the medical
15   information records into a run-time memory in
response to a request to load the data from the
database;
        forming one or more first subsets of said
predefined set of data, each subset being formed
20   according to predefined first subset criteria;
        forming one or more second subsets of said
one or more subsets, each second subset being
formed according to predefined second subset
criteria for a specific one of one or more
25   application programs that can run on the system,
each of which performs one or more operations on
data in said database;
        routing each first subset in response to a
request from one of the application programs,
30   according to predefined workqueue routing
criteria, to a workqueue for one of the
application programs, and routing each second
subset, according to predefined workqueue routing
criteria, to a workqueue for the application

35

program whose predefined second subset criteria
were used to form the second subset; and
        assigning each first subset and second
subset, according to predefined resource
5   assigning criteria, to a resource for one
workqueue,
        whereby a user identified to the system as a
particular resource running a particular
application program is allowed access only to
10   those first subsets or second subsets assigned to
that particular resource for that resource's
associated workqueue for the particular
application program that is running.

15

        8. A method as claimed in claim 7 further
comprising the step of storing on a storage medium
configuration data regarding the application programs,
the workqueues for each application program, the
20   resources for each workqueue, the predefined subset
criteria, the predefined workqueue routing criteria,
and the predefined resource assigning criteria.

25   9. A computer system as claimed in claim 8
wherein said step of storing configuration data
comprises storing the configuration data in a run-time
configuration file.

30

        10. A method for storing and tracking medical
information records on a computer system comprising
the steps of:
        storing data regarding the medical
35   information records in a relational database;

identifying when data constituting a
predefined set of data has been added to the
database;

forming one or more subsets of said

5   predefined set of data, each subset being formed
according to predefined subset criteria;

routing each subset, according to predefined
workqueue routing criteria, to a workqueue for
one of the application programs; and

10   assigning each subset, according to
predefined resource assigning criteria, to a
resource for one workqueue,

whereby a user identified to the system as a
particular resource running a particular

15   application program is allowed access only to
those subsets assigned to that particular
resource for that resource's associated workqueue
for the particular application program that is
running.

20

11. A method as claimed in claim 10 further
comprising the step of storing on a storage medium
configuration data regarding the application programs,

25 the workqueues for each application program, the
resources for each workqueue, the predefined subset
criteria, the predefined workqueue routing criteria,
and the predefined resource assigning criteria.

30

12. A computer system as claimed in claim 11
wherein said step of storing configuration data
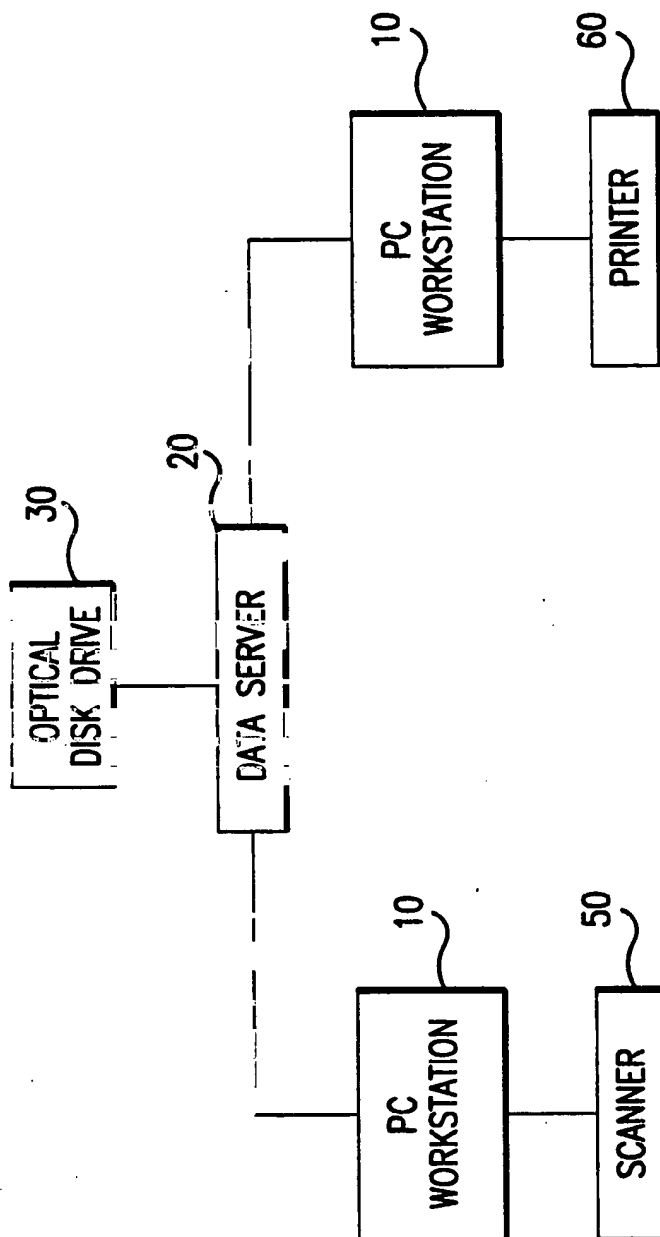comprises storing the configuration data in a run-time
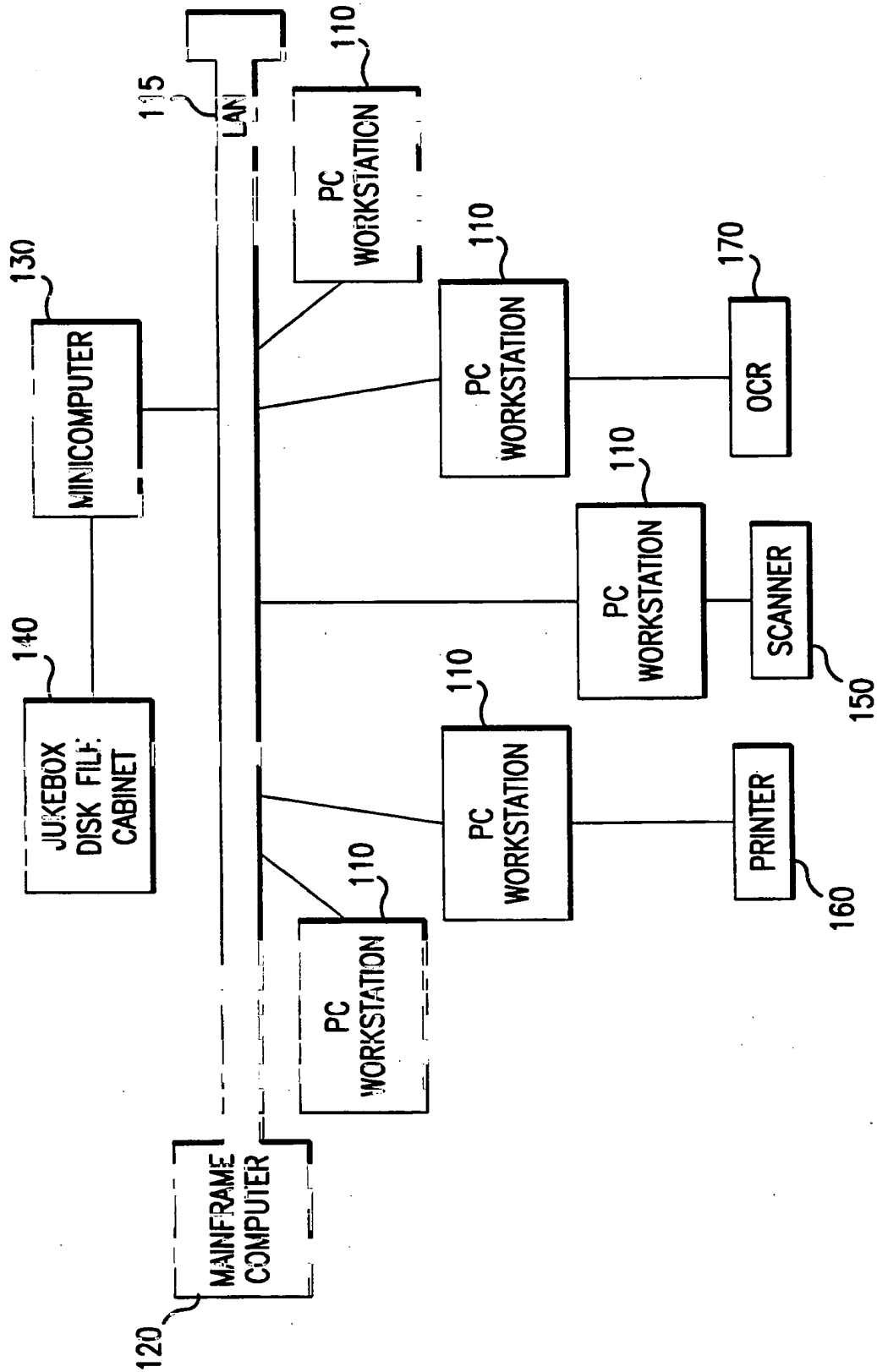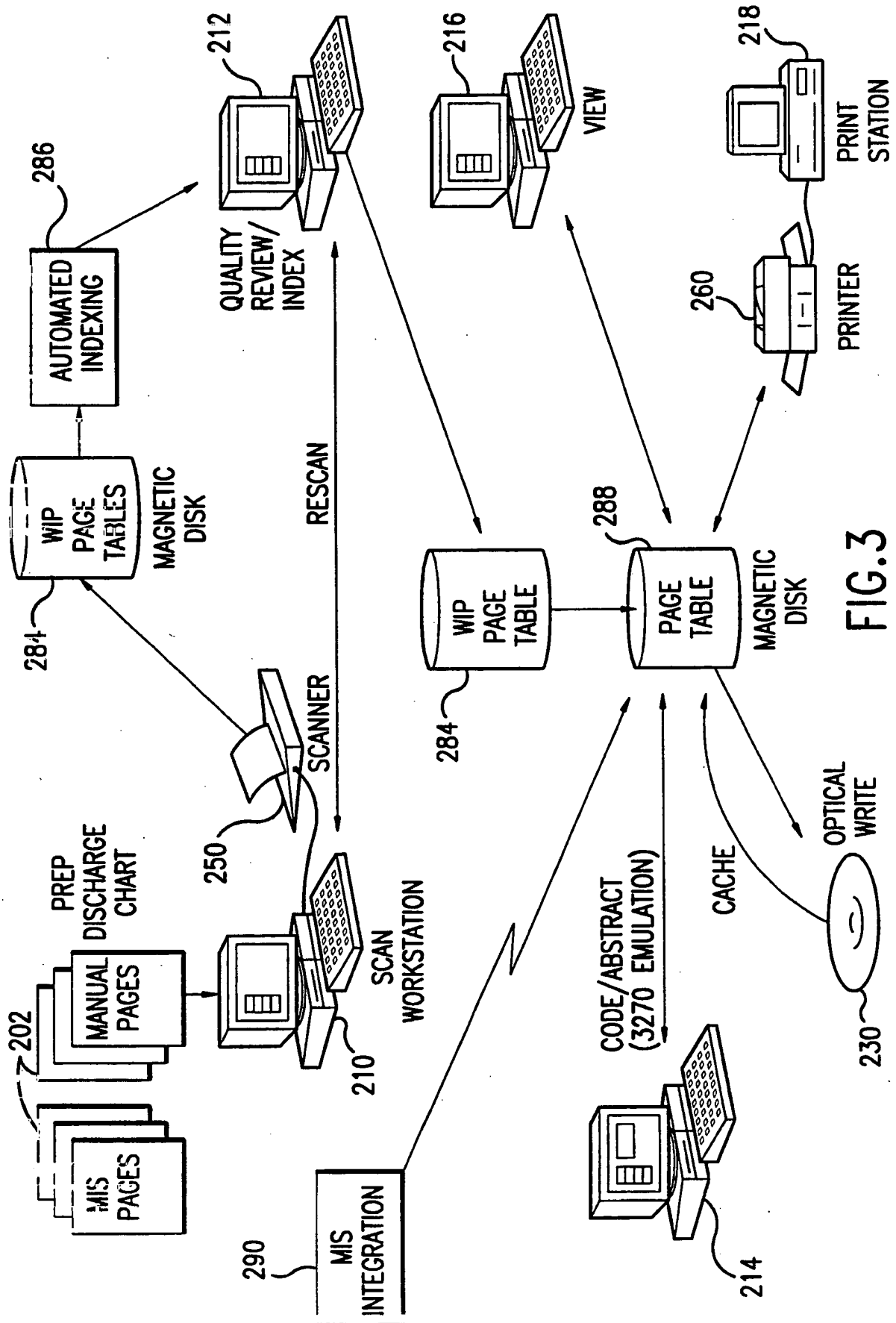configuration file.

35
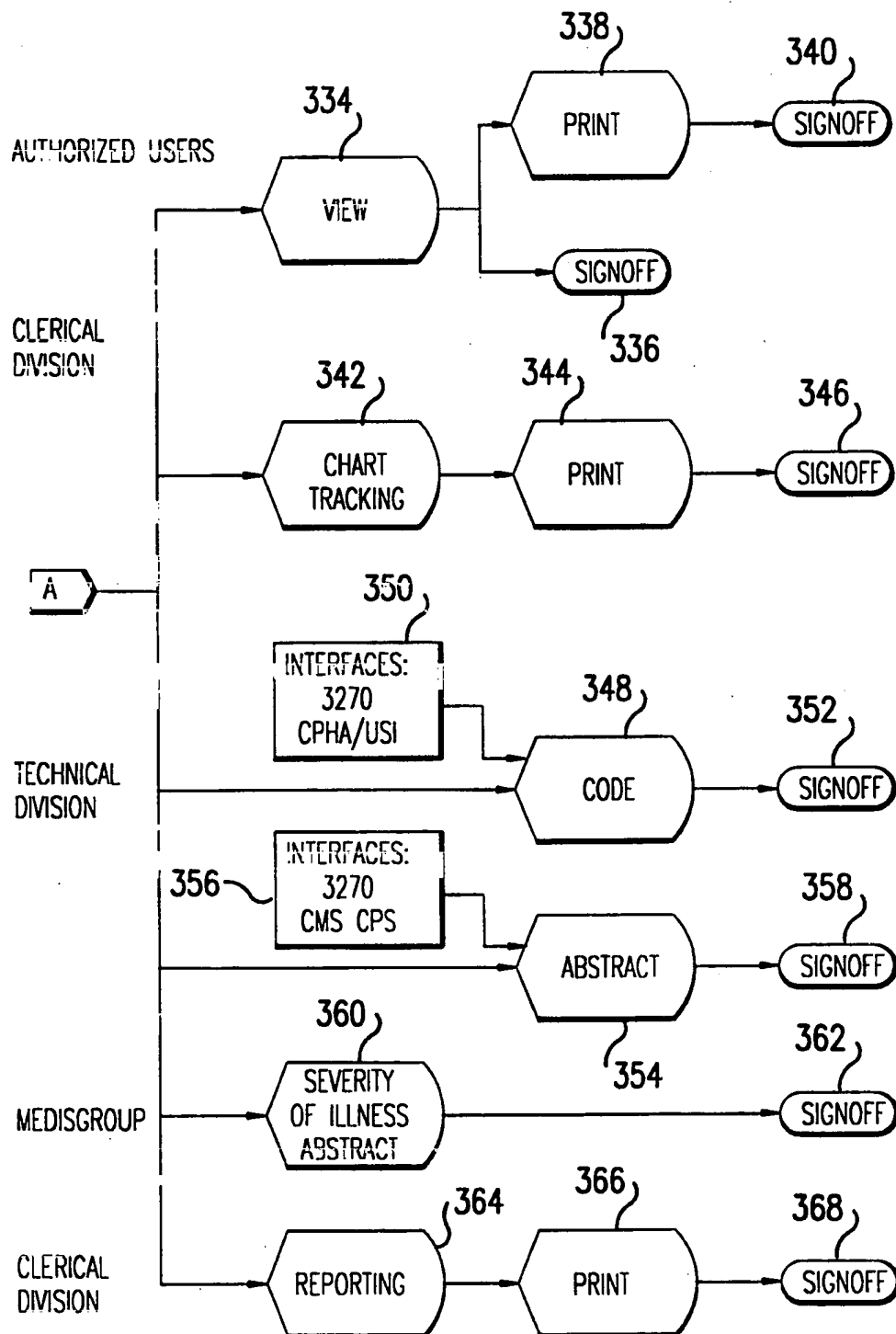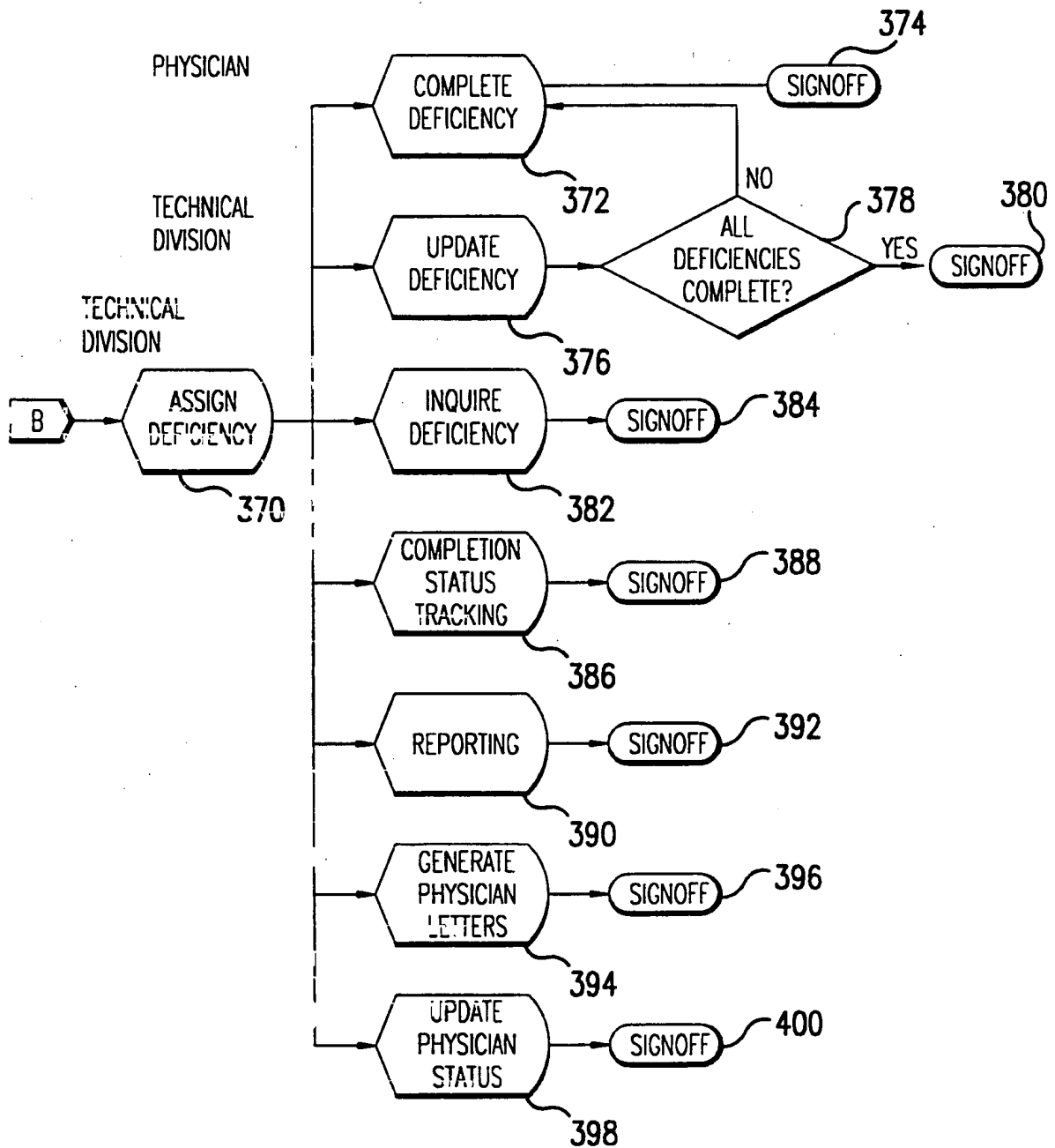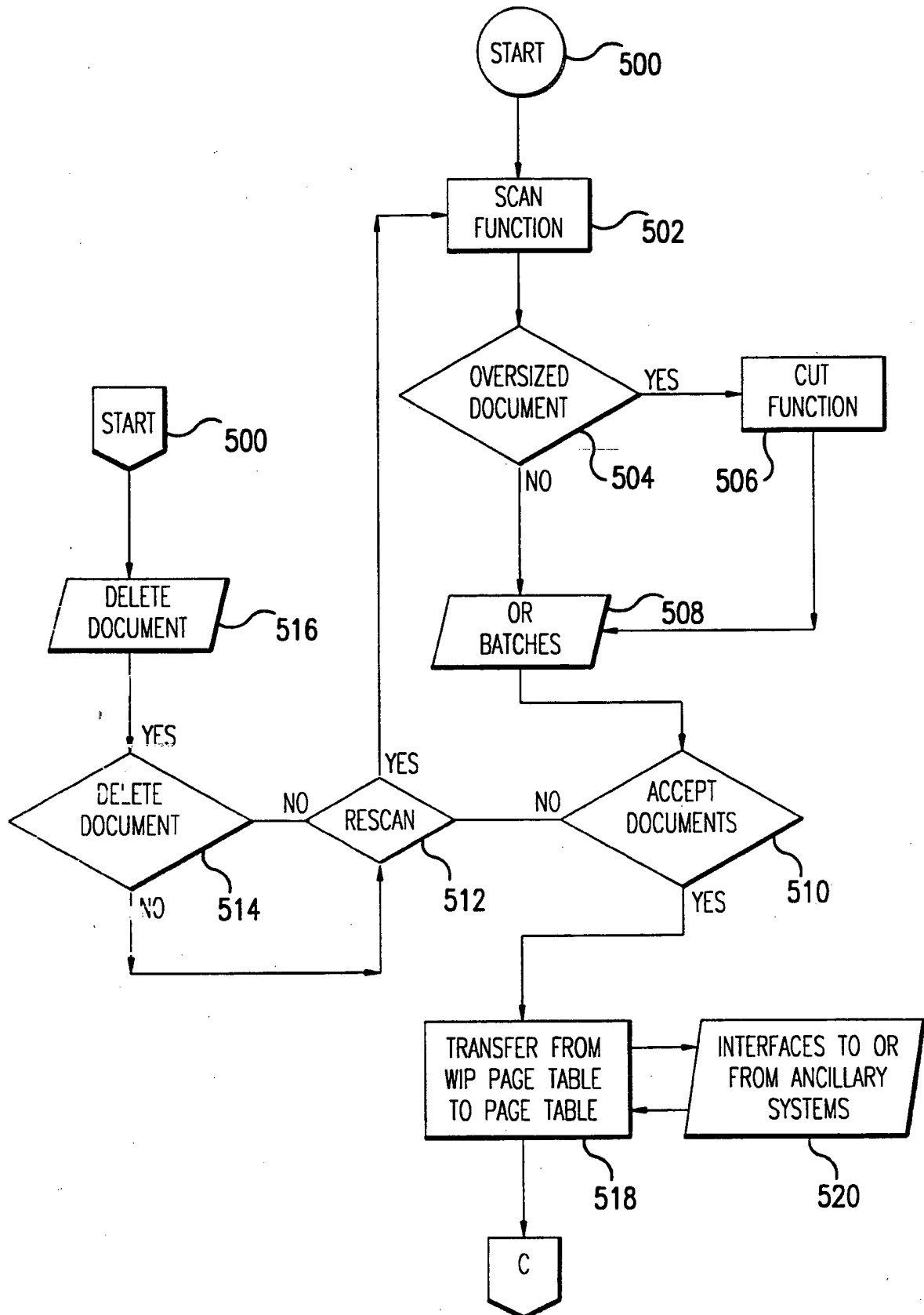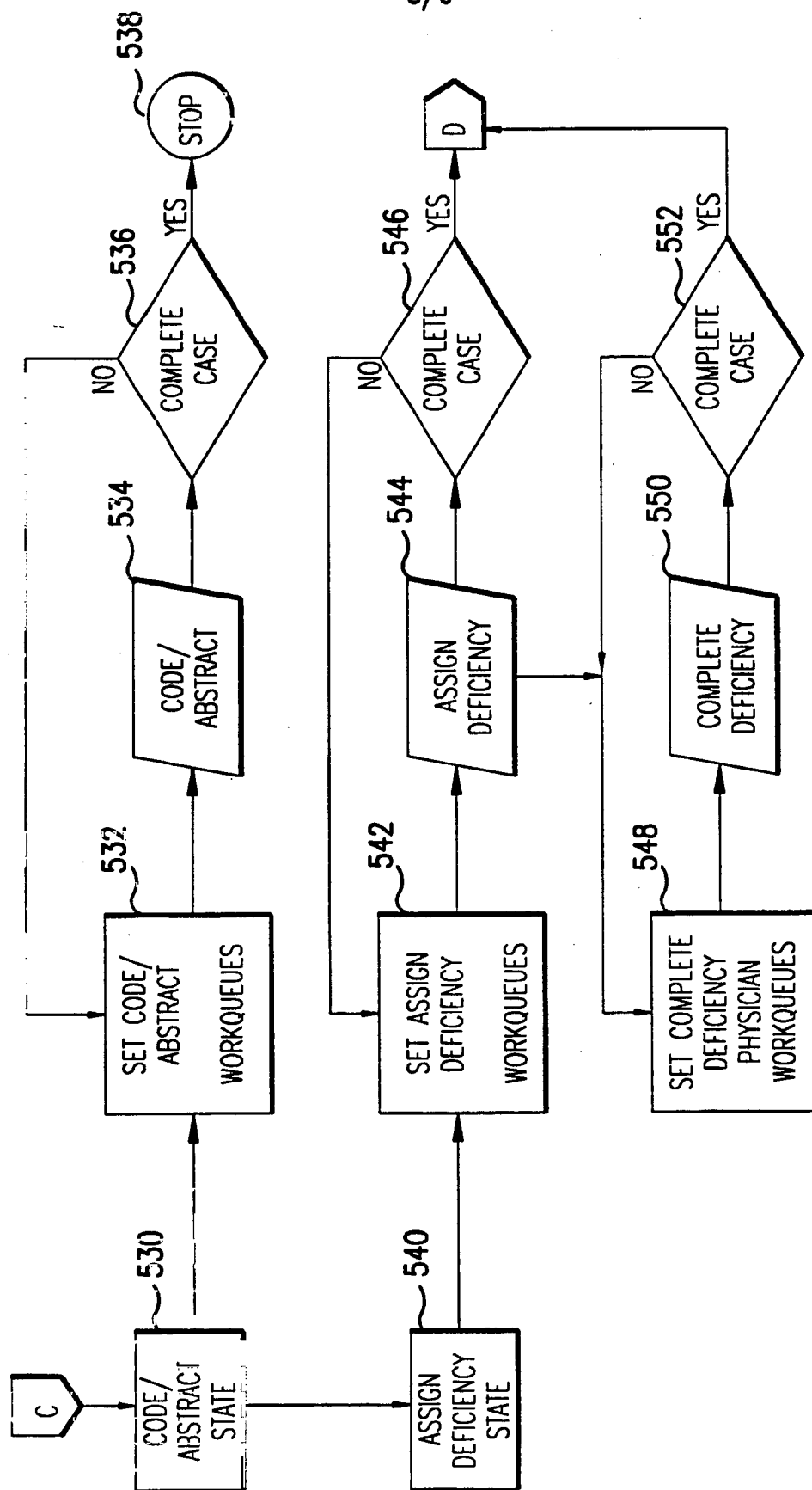
FIG.1

FIG.2

FIG.3

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FIG.4
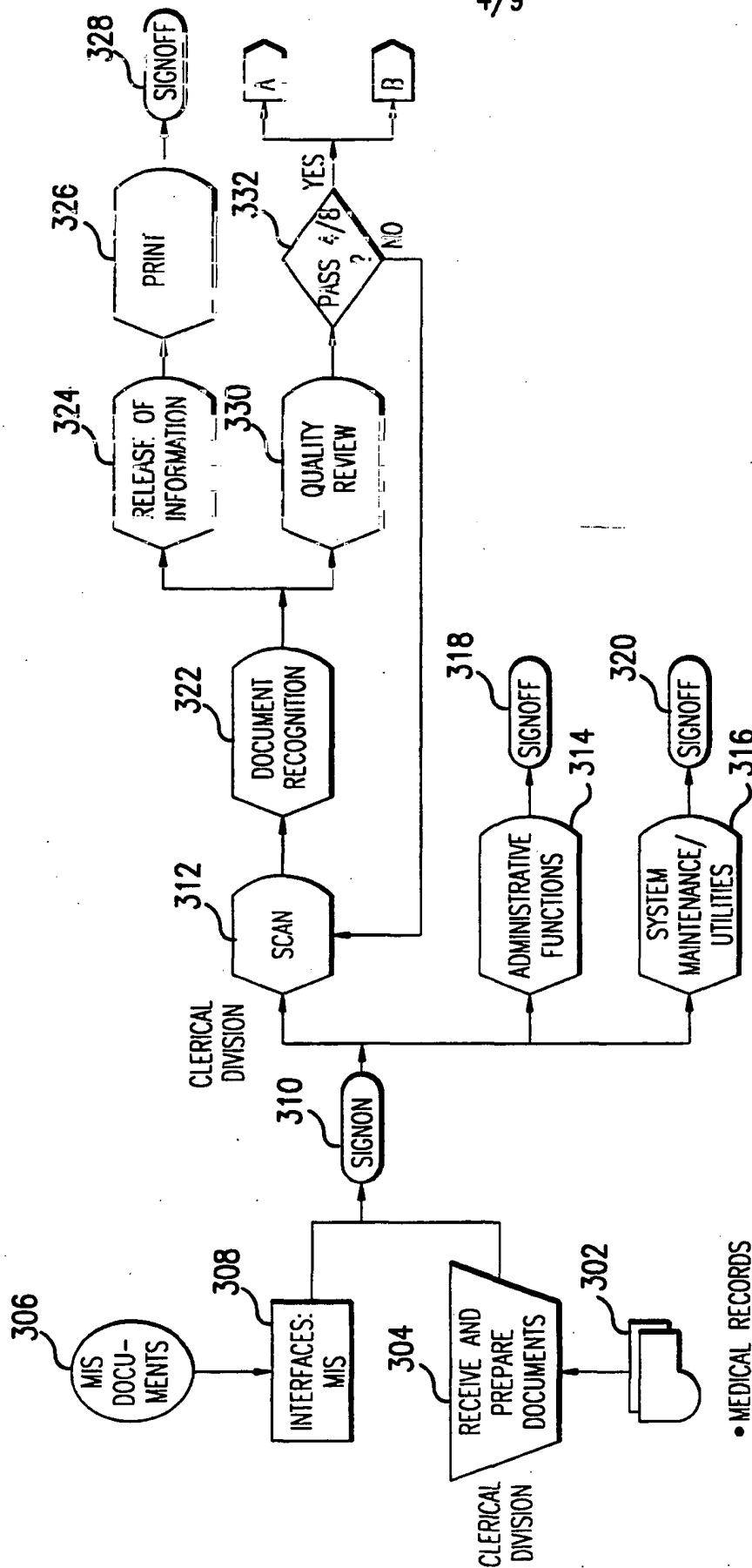
- MEDICAL RECORDS
- TRAUMA CENTER RECORDS
- MISCELLANEOUS MEDICAL RECORD DOCUMENTS
- RELEASE OF INFORMATION DOCUMENTS

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FIG.5

FIG.6

START — 500

SCAN
FUNCTION — 502

OVERSIZED
DOCUMENT   YES → CUT
FUNCTION

NO — 504   506

START — 500

DELETE
DOCUMENT — 516

OR
BATCHES — 508

YES

DELETE
DOCUMENT   NO   RESCAN   NO   ACCEPT
DOCUMENTS

NO — 514   512   YES   510

TRANSFER FROM
WIP PAGE TABLE
TO PAGE TABLE → INTERFACES TO OR
FROM ANCILLARY
SYSTEMS

518   520

C

FIG.7

FIG.8

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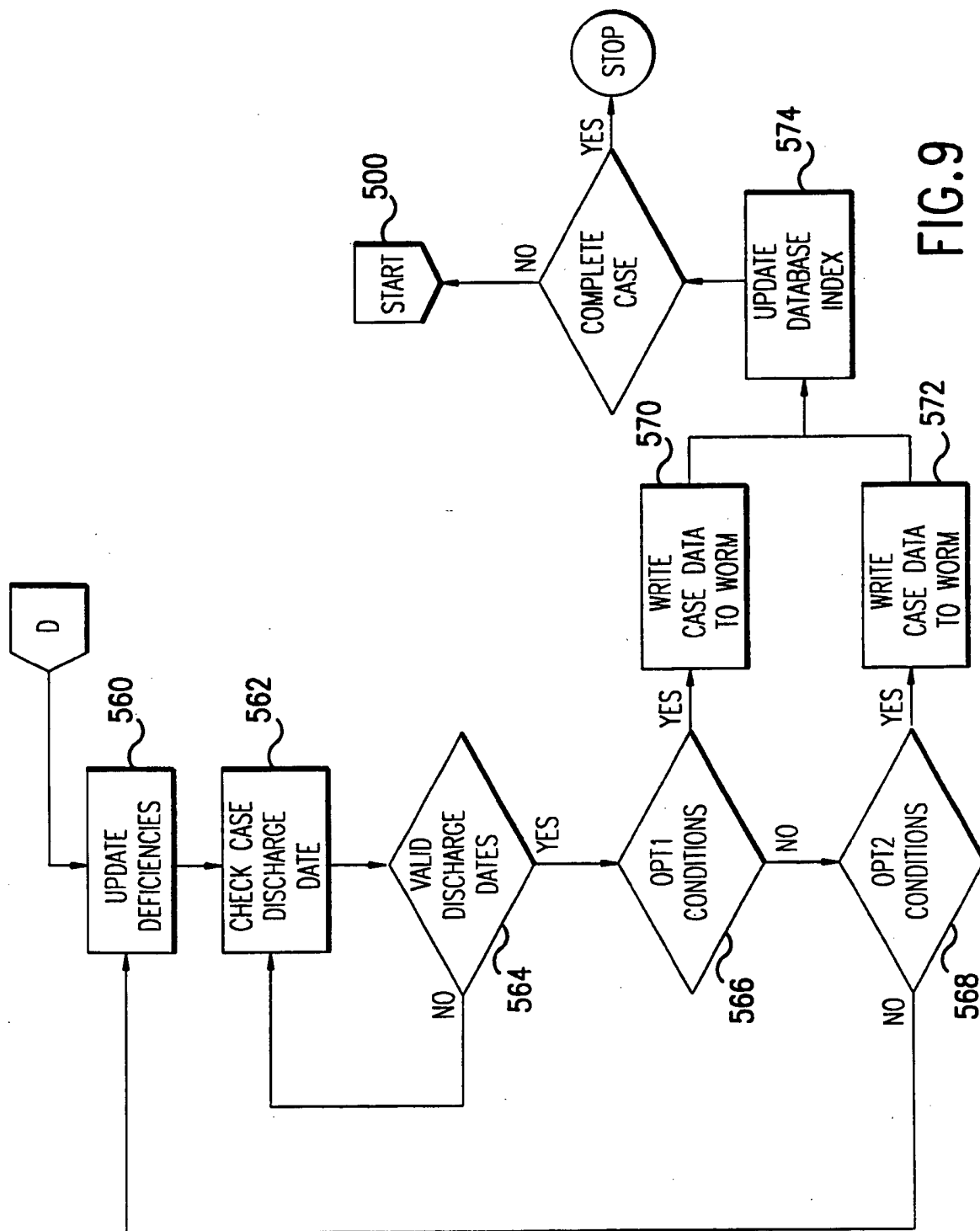
FIG.9

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :GO6F: 15/22; 15/24

US CL :364/401

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 364/401; 364/413.02, 413.13, 284.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Please See Extra Sheet.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim N .
Y,A	U.S.A., 4,958,283 (TAWARA ET AL) 18 SEPT 1990	1-12
Y,P	U.S.A., 5,168,444 (CUKOR ET AL.) 01 DECEMBER 1992. SEE COL. 11, LINE 12 TO COL. 12, LINE 16.	1-12
Y,P	U.S.A., 5,101,476 (KUKLA) 31 MAR 1992 SEE COL. 3, LINE 49 TO COL. 6, LINE 26	1-12

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance		
"E"	earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 AUGUST 1993	09 SEP 1993

Name and mailing address of the ISA/US	Authorized Officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	ROY ENVALL
Facsimile No. NOT APPLICABLE	Telephone No. (703) 305-9711

B. FIELDS SEARCHED

Electronic data bases consulted (Name of data base and where practicable terms used):

APS (AUTOMATED PATENT SYSTEM)

S   L1   APPLICATION PROGRAM# AND WORKQUEUE#
S   L2   WORKQUEUE#
S   L3   QUEUE#
S   L4   APPLICATION PROGRAM#
S   L5   L3 AND L4
S   L6   L5 AND CRITERIA
S   L7   L6 AND ROUT?